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BOTANICAL OBSERVATIONS IN SOUTHERN UTAH.

BY C. C. PARRY.

No. 3.

WHEN exposed to the withering summer heat of 105° to 110° F. in the valley of the Virgen, it was tantalizing to see within twenty miles to the north the rugged slopes of Pine Mountain streaked with patches of snow. Having secured most of the lowland and desert plants, I was anxious to supplement my collection with the alpine flora of the adjoining high mountain districts. Accordingly, on the 8th of June, I undertook an excursion to Pine valley, occupying an extensive basin on the northwest slope of Pine Mountain, thirty miles by the travelled road from St. George. Our route, which if practicable would have followed up the valley of the Santa Clara to its extreme sources, mounted by a series of very steep ascents to the abrupt sandstone ridges bounding the valley on the left. Higher up the rugged features of the bald uplands are greatly exaggerated by a confused intermingling of sedimentary and igneous rocks. Recent volcanic overflows had partly filled up the denuded sandstone ravines, with floods of black, scoriaceous lava. Some distance farther on the source of these igneous products is brought to view in two distinct volcanic cones, with clearly defined craters. The course of the Santa Clara through this confused labyrinth of aqueous and igneous deposits, is completely hid from view in inaccessible chasms. At a considerable elevation towards the foot-hills of Pine Mountain, there is a stretch of comparatively level country, scantily watered by irregular snow-fed streams, known as Damaran Valley. Here the polymorphous evergreen shrub oak (*Quercus undulata* Torr.) makes its appearance associated with the still more spiny-leaved Barberry (*Berberis Fremontii* Torr.). Occasionally in strongly impregnated saline soil, was noticed a broad leaved Lycium, the species of which, on account of the absence of flower or fruit, could not be satisfactorily determined.

Frequent along the roadside was an old Californian acquaintance, *Platystemon Californicum* Benth. (No. 8), not heretofore known east of the Sierra Nevada, and as if to keep up the distant

association there were occasionally extensive patches of *Emmenanthe penduliflora* Benth. (No. 175). In our noon halt under the shelter of a wagon-bed, it was quite refreshing to be able to gather an abundance of *Gilia filifolia* Nutt. (No. 195) and *Centrostegia Thurberi* Gray (No. 232), without necessary exposure to the hot sun. In crossing over the prolonged spurs of the mountain range to reach the northwestern slope of Pine mountain, we encounter a growth of clumpy cedars, in the shelter of which were found scattering plants of the *Frasera albo-marginata* Watson (No. 203) only known before from scanty specimens collected by Dr. Palmer in this same section in 1870. In similar gravelly stretches we also find *Caulanthus crassicaulis* Watson, *Physaria Newberryi* Gray, and *Thelesperma subsimplicifolium* Gray (No. 108). Quite conspicuous along the borders of rivulets and moist springy places, occurred the showy-flowered *Pentstemon Palmeri* Gray, lately extensively introduced into gardens from seed distributed by Mr. A. L. Siler.

Our upward route occasionally crossing the clear dashing stream of the Santa Clara along its upper course, finally emerged into the wide open basin of Pine valley, lying at the base of steep mountain ridges heavily timbered with pine and spruce. The regular outlines of this basin at once indicate it as the bed of an ancient lake, since drained through the deep gash through which the Santa Clara courses to mingle its tribute of melting snow with the turbid waters of the Virgin. The atmospheric coolness of this elevated district afforded a refreshing contrast with the torrid heat of the lowlands, and was especially noticeable in the vegetation, which exhibited a more northern aspect. In the cultivated fields the difference was equally striking; wheat then ready for harvest at the mouth of the Santa Clara, was just spreading out its early leaves at its upper sources; cotton-woods which several weeks before had opened their bolls in St. George, were barely in bud at Pine valley. In fact the flowering season in these elevated districts was only just commenced, and the bald alpine ridges toward the summit of the range showed no signs of advancing vegetation, being still occupied by scattered snow drifts. Under these circumstances only the lower slopes afforded scope for botanizing during the short stay devoted to this section.

Disagreeably abundant in all the foot-hills, as a serious impediment to comfortable travelling, is the deciduous leaved shrub oak

(*Quercus undulata* Torr. var. *Gunnisoni* Engel. ined.). Much more attractive with its glossy foliage and long feathery seeds, is the mountain mahogany, *Cercocarpus ledifolius* Nutt. (No. 58), which here attains the dimensions of a small tree often twenty feet in height, with trunks six to eight inches in diameter. Along the borders of all the numerous mountain streams the common alder (*Alnus incana* var. *glauca*) is abundant, associated as elsewhere in the Rocky Mountain districts with *Betula occidentalis* Hook. As if to complete on a small scale the resemblance with analogous eastern sections, the western sugar maple (*Acer grandidentatum* Nutt.) makes its appearance. Though generally of a low bushy growth, it occasionally attains the size of a small tree, with trunks a foot or more in diameter. The wood in hand specimens is undistinguishable from our hard maple, and is applied to similar uses. The Coniferæ of this section include, on the lower slopes extending down into the valley, large trees of *Pinus ponderosa* and *Abies Douglasii*, succeeded higher up by scattering growths of *Pinus flexilis* and *Abies concolor*, and towards the summit by dense forests of *Abies Engelmanni*. The highest elevation is at no point sufficient to show a well-defined timber line, though bare alpine patches are spread out at various exposed points near the summit of the range. The lower dividing ridge to the north and west is mainly occupied by a scattering growth of cedar, the undergrowth affording the following plants, viz.: *Physaria Newberryi* Gray (No. 14), *Pachystima myrsinites* Raf., *Astragalus atratus* Watson (No. 47), *Hymenopappus luteus* Nutt. (No. 107), *Gilia aggregata* var. *Bridgesii* (No. 194), *Echinosperrum deflexum* Lehn. (No. 172).

In the upper portion of the main valley was found a very neat species of *Trifolium* with large reflexed heads, *Trifolium Bolanderi* Gray (No. 34). Near by on the borders of a springy bog occurred in great abundance the interesting *Lewisia Brachycalyx* Engel. (No. 22). This rare species, only known heretofore by a few imperfect fragments, will be characterized anew by Dr. Engelmann in the accompanying list. Though much inferior in beauty to the northern typical species (*Lewisia rediviva* Ph.), it still presents the same style of flower and foliage on a somewhat smaller scale, and being undoubtedly hardy, may be improved by cultivation. Some of the more familiar aspects of the sub-alpine flora were presented in the well known Rocky Mountain forms of *Aqui-*

legia cœrulea Torr., *Mertensia sibirica* Don., and *Polemonium humile* Willd. It would have been interesting later in the season to have made a more thorough examination of the high alpine exposures, which from their isolated position would doubtless afford rare or new species. The exchange from the cool snow-drifts of Pine mountain to the oven heat of St. George proved much less pleasant than the reverse process, though more easily accomplished. It is worthy of remark in this connection to note the mutual dependence of these two strongly contrasted but adjoining districts. Thus the moisture, condensed either in the form of summer rain or winter snow on these high mountain ridges, is not all exposed in open water courses to be directly returned to the atmosphere by the intense evaporation of the lower desert tracts. A large part of it sinks into the pervious sandstone strata, dipping towards the south, thence working its way through deep unseen channels, it breaks out in the form of copious springs at the base of the high cliffs bounding the Valley of the Virgin. From this source is derived the necessary supplies of irrigating water for the gardens of Washington and St. George. In return, these semi-tropical districts contribute to the dwellers in the mountains the elaborated products of the choicest garden fruits that would be otherwise unattainable. Without such a mutual exchange neither of these sections would be as well adapted as now for civilized habitation.

On the 25th of June having completed my botanical collection in the valley of the Virgin, I left on my return route to Salt Lake, having arranged to spend a few weeks in the more elevated districts within the rim of the great basin.

On reaching Cedar city, sixty miles to the north of St. George, in the latter part of June, it was not very encouraging to note that the continued dry season had in a great measure completed the development of the early Spring plants, which were but scantily succeeded by later summer forms. On the rocky and variegated marly exposures adjoining the town, the conditions seemed especially favorable for a peculiar flora, and this expectation was in a measure realized, though in scanty forms. Among these is a well marked new species of *Gaillardia* characterized by Prof. Gray as *Gaillardia acaulis* n. sp. (No 120).

Here also occurred quite abundantly a species of *Lepidium* near to *Lepidium integrifolium* Nutt., or possibly a new species (No. 16).

Other rarities include *Polygala subspinoso* Watson (No. 32), *Brickellia linifolia* D. C. Eaton (No. 89) and *Eriogonum villiflorum* Gray (No. 243). On one of the exposed rocky slopes was gathered a dwarfed variety of *Cercocarpus ledifolius* Nutt., or possibly a new species to which the name of *Cercocarpus intricatus* n. sp. (No. 59) may be provisionally applied. Along the gravelly margins of Cedar Creek was found *Astragalus Sonoræ* Gray (No. 53), *Astragalus longocarpus* Gray (No. 52) *Thelesperma subnudum* Gray, n. sp. (No. 109) and *Lygodesmia grandiflora* Gray (No. 128). On shaded hill-sides, *Cercocarpus ledifolius* Nutt., *Cowania Mexicana* Don. and *Fraxinus anomala* Torr. (No. 210), are abundant. Having soon exhausted this scanty flora, my attention was directed to the high mountain range of the Wahsatch, rising abruptly to the East, and overlooking the southern extension of the great interior basin. An ascent of about 3,000 feet in a distance of three miles, brings us to the outer crest of the range, which extends eastward in an irregular series of undulations to the upper Sevier valley. At several points on the lee side of steep ridges there were still the remains of rapidly wasting snow banks. Notwithstanding the comparative elevation and freshness of vegetation, there was a scant supply of surface water except immediately adjoining large snow banks. The prevalent timber growth was made up of interrupted groves of Aspen popular, some high ridges in the distance showing a few scattered pines and spruces. Four miles back towards the interior of the range, the country expands into wide grassy slopes, and frequent springs and running streams bordered by snow drifts, give unwonted freshness to the pastoral scenery. Here is located the summer sheep range, and dairy farms of this district, of which the only apparent drawback to their attractive and productive features, is the annoying prevalence of blood-thirsty flies.

The botanical features are very similar to other elevated pastoral districts in the interior West. Senecios and Arnicas serve to give a yellow cast to the open grassy meadows; shades of blue are supplied by thrifty *Delphiniums*. In the aspen copses there is a dense undergrowth made up mainly of *Prunus*, *Rosa*, *Symphoricarpos*, and *Salix*. Less conspicuous but more interesting as peculiar to the flora of this district may be noted *Calandrina pygmæa* Gray, *Trifolium eriocephalum* Gray (No. 35), *Oxytropis campestris* var.? and *Cordylanthus Kingii* Watson (No. 156).

The destructive effects of exclusive sheep grazing on the native forage grasses, was manifest in a disagreeable prevalence of the common yarrow (*Achillea millefolium* L.), wherever the herds had been long stationed. On other hill slopes the entire vegetation was usurped by a bushy perennial umbelliferous plant. *Ligusticum Scopulorum* Gray (No. 82), which alone seemed capable of withstanding the destructive effects of close grazing; possibly its protection is due to some nauseous quality serving to keep the sheep herds at a distance.

On account of the severity of the weather, and the great depth of winter snow, this mountain section is abandoned in the winter for the warmer, though less productive sage-brush lowlands. No attempt has yet been made to establish permanent settlements here for the cultivation of the rich soil, though apparently admirably fitted for the growth of the hardier small grains and root crops.

After spending a few days very pleasantly in the rude homes of these hospitable herders, I returned to Cedar city, by a very direct trail, leading down the steepest part of the mountain slope. On this route I was fortunate in securing good fruiting specimens of *Astragalus megacarpus* Gray (No. 51), hitherto only known from Nuttall's original specimens.

On this same trip my attention was particularly directed to the two species of Rocky mountain balsam, *Abies grandis* Lindl., and *Abies concolor* Engel. ined.; in regard to which so much needless confusion has arisen. I here found the two species growing not far distant from one another, and exhibiting plainly their distinctive characters (as trees if not as herbarium specimens). Thus we may note *Abies grandis* with a more strict habit, narrower leaves, smooth bark (at all sizes) and deep purple cones, more exclusively confined to high elevations. *Per contra*; *Abies concolor*, less pyramidal in shape, with much broader leaves, rough furrowed bark (in old trees) and apple-green cylindrical cones, found growing at much lower elevations on the mountain slope, and less exclusively confined to moist ground. It is to be hoped that this latter species may soon be introduced into cultivation when its ornamental qualities can be more fully developed. Succeeding my return from the mountain range summer rains set in with unusual frequency and copiousness. Dark thunder clouds hovering about the distant mountains to the east which they illuminated with the

most brilliant electrical discharges, were the sure precursors of floods sweeping down the rocky bed of Cedar creek. The particular location of each storm was plainly indicated by the different colored mud, brought down on the swollen flood, varying from dark brown to dirty yellow or dull red. The stratified deposits thus spread over the bed of the great basin made up the permanent geological record of summer storms in the Wahsatch in 1874.

On the 20th of July I took final leave of this section of southern Utah, carrying with me many pleasant remembrances of the kindness and hospitality received from this much misrepresented Mormon people, who in supplanting the digger Indians by civilized homes of industry and refinement, are deserving of more credit than they have yet received.

The list of plants following will conclude the present paper.

THE INDIAN CEMETERY OF THE GRUTA DAS MUMIAS, SOUTHERN MINAS GERAES, BRAZIL.

BY PROF. CH. FRED. HARTT.

THE Fazenda da Fortaleza, also known as Santa Anna, formerly the property of the late Barão de Lage, and probably the finest plantation in Brazil, is situated in the southern part of the province of Minas Geraes at a distance of about seventeen miles to the east of the city of Juiz de Fora.¹ It belongs to-day to the Conselheiro Diogo Velho C. de Albuquerque, a gentleman celebrated as a politician, and who occupies the important post of President of the União Industria road. The region in which the Fazenda is situated is composed of gneiss, similar to that of the Serra do Mar, and of the vicinity of Rio de Janeiro, and probably of Archæan age.

At a distance of a league, more or less, to the south or south-east of the Fazenda, is a line of high hills of the same gneiss, three of which form prominent heads presenting lofty, almost perpendicular precipices, smooth and rounded and striped vertically with black bands, like the cliffs of the neighborhood of Rio de Ja-

¹ A charming description of this fazenda will be found in Madam Agassiz's "Journey in Brazil."